CLAIMS

1-6. (Cancelled)

7. (Previously Presented) A system for optically recording information in a storage medium comprising:

the storage medium comprised of a polymer material doped with a plurality of azobenzene molecules each possessing photoisomerization and molecular reorientation properties;

a first coherent light source that is optically coupled to irradiate the storage medium with light having a red wavelength; and

a second light source that is optically coupled to irradiate the storage medium with light having a blue wavelength;

wherein each of the plurality of the azobenzene molecules is isomerizable from a trans isomer to a cis isomer upon irradiation with light having the blue wavelength, and each of the plurality of the azobenzene molecules is isomerizable from the cis isomer to the trans isomer upon one of thermal relaxation and irradiation with light having the red wavelength,

and wherein the light from the second light source is uniform and has a p-polarization, while the light from the first coherent light source has an s-polarization and forms a pattern that represents the information being recorded, the pattern providing bright fringes in a first plurality of locations in the storage medium and providing dark fringes in a second plurality of locations in the storage medium, the light from the first coherent light source and the second light source causing the plurality of azobenzene molecules in the first plurality of locations to be trans isomers oriented essentially perpendicular to the p-polarization, and in the second plurality of locations comprise of a first subset that are trans isomers oriented essentially perpendicular to the p-polarization and a second subset that are cis isomers that can reorient,

and, upon removal of the light from the first coherent light source and the second light source, the storage medium forming a non-volatile orientation grating at a temperature below a glass transition temperature of the polymer material, the storage medium including

the polymer material doped with the plurality of azobenzene molecules that in the first plurality of locations are trans isomers oriented essentially perpendicular to the p-polarization, and in the second plurality of locations comprise of the first subset that are trans isomers oriented essentially perpendicular to the p-polarization and the second subset that are trans isomers oriented randomly.

8-32. (Canceled)

33. (Previously Presented) The system of claim 7, further comprising only the second light source optically coupled to irradiate the storage medium with light having a circular polarization for a period of time to result in substantially all of the plurality of azobenze molecules to be oriented randomly.

34. (Previously Presented) The system of claim 7, wherein the information is read from the storage medium upon irradiation with a uniform light from the first coherent light source having a wavelength that is the same as the red wavelength.

35. (Previously Presented) The system of claim 34, wherein the storage medium maintains the non-volatile orientation grating upon irradiation with the uniform light from the first coherent light source having a wavelength that is the same as the red wavelength.

36. (Previously Presented) The system of claim 7, wherein below the glass transition temperature of the polymer material, the polymer material forms a matrix in which the trans isomers cannot reorient.

37. (Previously Presented) The system of claim 7, wherein the polymer material is a poly vinyl alcohol polymer material.

38. (Previously Presented) The system of claim 37, wherein the glass transition temperature of the polymer material is approximately 85 degrees Celsius.

39. (Previously Presented) The system of claim 7, wherein the polymer material is a PMMA polymer material.

40. (Previously Presented) The system of claim 7, wherein the pattern is an interference pattern of a plurality of beams originating from the first coherent light source.

41. (Previously Presented) The system of claim 7, wherein the red wavelength is approximately 647 nm and the blue wavelength is approximately 442 nm.

42. (Previously Presented) A system for optically reading information recorded in a storage medium as a non-volatile orientation grating, the system comprising:

the storage medium including a polymer material doped with a plurality of azobenzene molecules that in a first plurality of locations are trans isomers oriented essentially parallel to a direction, and in a second plurality of locations comprise of a first subset that are trans isomers oriented essentially parallel to the direction and a second subset that are trans isomers oriented randomly, wherein the first plurality of locations and the second plurality of locations form the grating that represents the information;

a coherent light source coupled to irradiate the storage medium with light having a red wavelength; and

a photodetector locating the grating by detecting light from the coherent light source diffracted off of the storage medium, wherein a diffraction index of the storage medium in the first plurality of locations is different from a diffraction index of the storage medium in the second plurality of locations.

43. (Previously Presented) The system of claim 42, wherein the coherent light source irradiates the storage medium with light having the red wavelength that is the same as a wavelength used for recording the information.

44. (Previously Presented) The system of claim 42, wherein the storage medium maintains the non-volatile orientation grating upon irradiation by the coherent light source having a red wavelength.

45. (Previously Presented) The system of claim 42, wherein the storage medium is at a temperature below the glass transition temperature of the polymer material, wherein the polymer material forms a matrix in which the trans isomers cannot reorient.

46. (Previously Presented) The system of claim 42, wherein the polymer material is a poly vinyl alcohol polymer material.

47. (Previously Presented) The system of claim 46, wherein the glass transition temperature of the polymer material is approximately 85 degrees Celsius.

48. (Previously Presented) The system of claim 42, wherein the polymer material is a PMMA polymer material.

49. (Previously Presented) A method of optically recording information in a storage medium comprised of a polymer material doped with a plurality of azobenzene molecules, each of the plurality of azobenzene molecules possessing molecular reorientation properties and being isomerizable from a trans isomer to a cis isomer upon irradiation with light having a blue wavelength, and being isomerizable from the cis isomer to the trans isomer upon one of thermal relaxation and irradiation with light having a red wavelength, the method comprising:

partially reorienting the plurality of azobenzene molecules by irradiating the storage medium with a first coherent light source that irradiates the storage medium with light having the red wavelength, and light from a second light source that irradiates the storage medium with light having the blue wavelength,

wherein the light from the second light source has a p-polarization and is uniform, while the light from the first coherent light source has an s-polarization and forms a pattern that represents the information being recorded, the pattern providing bright fringes in a first plurality of locations in the storage medium and providing dark fringes in a second plurality of locations in the storage medium,

wherein, in the first plurality of locations and the second plurality of locations, the light from the second light source interacts with trans isomers that are not oriented perpendicularly to the p-polarization by isomerizing said trans isomers to cis isomers, and

wherein, in the first plurality of locations, the light from the first light source interacts with cis isomers by isomerizing said cis isomers to trans isomers; and

generating a nonvolatile orientation grating at a temperature below a glass transition temperature of the polymer material by removing the light from the first coherent light source and

the second light source for a relaxation period of time selected to be sufficiently long that cis isomers in the second set of locations relax to trans isomers having random orientations, while substantially all isomers located in the first set of locations are trans isomers having an orientation essentially perpendicular to the p-polarization.

50. (Previously Presented) The method of claim 49, wherein before partially reorienting the plurality of azobenzene molecules, the method further comprises generating a substantially randomly oriented distribution of trans isomers and cis isomers by irradiating the storage medium with light from the second light source which has a circular polarization and is uniform.

51. (Previously Presented) The method of claim 49, further comprising reading the information upon irradiating the storage medium with a uniform light from the first coherent light source having a wavelength that is the same as the red wavelength.

52. (Previously Presented) The method of claim 51, wherein the storage medium maintains the non-volatile orientation grating upon irradiation with the uniform light from the first coherent light source having a wavelength that is the same as the red wavelength.

53. (Previously Presented) The method of claim 49, wherein below the glass transition temperature of the polymer material, the polymer material forms a matrix in which the trans isomers cannot reorient.

54. (Previously Presented) The method of claim 49, wherein the polymer material is a poly vinyl alcohol polymer material.

55. (Previously Presented) The method of claim 54, wherein the glass transition temperature of the polymer material is approximately 85 degrees Celsius.

56. (Previously Presented) The method of claim 49, wherein the polymer material is a PMMA polymer material.

57. (Previously Presented) The method of claim 49, wherein the pattern is an interference pattern of a plurality of beams originating from the first coherent light source.

58. (Previously Presented) The method of claim 49, wherein the red wavelength is approximately 647 nm and the blue wavelength is approximately 442 nm.

59. (Previously Presented) A method of optically reading information recorded as a non-volatile orientation grating formed in the storage medium, the storage medium including a polymer material doped with a plurality of azobenzene molecules, that in a first plurality of locations are substantially all trans isomers oriented essentially parallel to a direction, and in a second plurality of locations comprise of trans isomers oriented randomly, wherein the first plurality of locations and the second plurality of locations form the grating that represent the information, the method comprising:

irradiating the storage medium with light from a coherent light source that irradiates the storage medium with light having a red wavelength, and having a difference in a diffraction index of the storage medium in the first plurality of locations and a diffraction index of the storage medium in the second plurality of locations; and

locating the non-volatile orientation grating by detecting light from the coherent light source diffracted off of the storage medium with a photodetector.

60. (Previously Presented) The method of claim 59, wherein the coherent light source irradiates the storage medium with light having the red wavelength that is the same as a wavelength used for recording the information.

61. (Previously Presented) The method of claim 59, wherein the storage medium maintains the non-volatile orientation grating upon irradiation by the coherent light source having a red wavelength.

62. (Previously Presented) The system of claim 59, wherein the storage medium is at a temperature below the glass transition temperature of the polymer material, wherein the polymer material forms a matrix in which the trans isomers cannot reorient.

63. (Previously Presented) The method of claim 59, wherein the polymer material is a poly vinyl alcohol polymer material.

64. (Previously Presented) The method of claim 63, wherein the glass transition temperature of the polymer material is approximately 85 degrees Celsius.

65. (Previously Presented) The system of claim 59, wherein the polymer material is a PMMA polymer material.